

AGRICULTURE

Project Fact Sheet



ENERGY-EFFICIENT CROP IRRIGATION

BENEFITS

- Saves energy and raw materials, with the potential to eliminate over 1 trillion Btu by delivering fertilizers and chemicals along with water rather than through air or ground transportation
- Reduces application costs, pesticide and water use, and chemicals leached into groundwater

APPLICATIONS

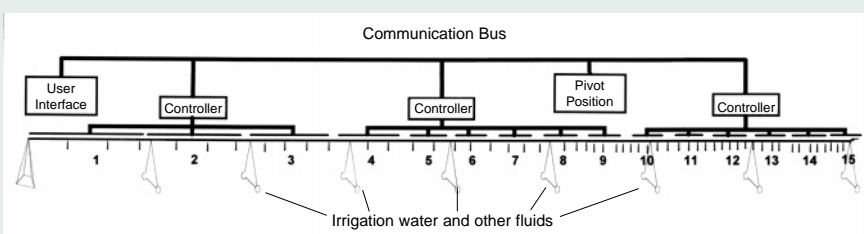
The energy-efficient irrigation system is useful for growers whose fields include areas of nonproductive land and whose fields have significant variations in soil properties, such as topography, texture, fertility, or water-holding capacity. Additional applications are possible in industrial and municipal wastewater plants, the forest products industry, chemical processing, and other industrial applications that use leaching processes.

PROGRAMMABLE LOGIC CONTROLLERS EXPAND CENTER-PIVOT SYSTEMS BEYOND SIMPLE IRRIGATION

Center-pivot irrigation systems are the leading method of crop irrigation in many agricultural zones across the United States. First commercially introduced in the 1950s, center-pivot systems are steadily replacing traditional flood irrigation and other types of sprinklers, such as “gun and boom.” Many of the irrigation conversions are being made to counter farm-labor shortages but, as an added benefit, center pivots are also highly efficient—an 80 to 85 percent rate of efficiency in terms of application uniformity. California State University’s Center for Irrigation Technology maintains that center pivots adapt most easily to the greatest number of conditions, such as soil type and topography.

Given the high performance of center-pivot systems and their increasing use, interest has been growing in expanding the system capabilities beyond irrigation to the application of water-soluble pesticides, fungicides, and fertilizers. Northwest Precision Ag, Inc., of Blackfoot, Idaho, is developing the methods and technology needed for better management of water resources. The energy-efficient irrigation system is an addition to center-pivot systems that gives growers new options for applying irrigated water and water-soluble chemicals and fertilizers. Refinements made possible through the technology’s computerized control panel allow banks of individual spray nozzles to adjust the rate of water application to suit varying requirements in different areas of the field. Using the energy-efficient irrigation system, water can be preprogrammed to shut off in areas of the field that are non-productive, such as rocky outcrops, roads, or streams. Likewise, additional water or fertilizer can be applied to meet the specific nutrient or water needs of a grower’s high-value crop, such as potatoes and tomatoes.

ENERGY-EFFICIENT IRRIGATION SYSTEM



This new irrigation technology can be tailored to suit individual watering needs, eliminating water and energy waste that can occur through irrigation of nonproductive land.



Project Description

Goal: Conduct tests and verify the feasibility of the energy-efficient irrigation system.

The energy-efficient irrigation system integrates global positioning system (GPS) equipment and software with computerized application technology that can be retrofitted on existing equipment or incorporated into the design of a new center pivot system. The main advantage over currently available center-pivot systems is the ability to customize water and fertilizer/chemical inputs to match irregular variations in soils, terrain, weed or pest infestations, or crop fertility needs.

The energy-efficient irrigation system has a series of programmable logic controllers (PLCs) that control banks of individual nozzles. The PLCs are linked to a central control unit that is programmed with georeferenced data on crop, field, and environmental conditions and needs. These data are used to adjust the delivery rate of water and/or fertilizers by cycling on and off alternate banks of nozzles. The operator can readily make changes using a menu-driven interface. The use of commercially available components is expected to keep the technology's costs down while ensuring system reliability.

Northwest Precision Ag, Inc., is developing this new technology with the help of a grant funded by the Inventions and Innovation Program in the Department of Energy's Office of Industrial Technologies.

Progress and Milestones

- Preliminary conceptual-stage work on the energy-efficient irrigation system began in 1996 shortly after the creation of Northwest Precision Ag, Inc.
- Verified water shutoff over unproductive ground.
- Efforts are underway to identify a potential strategic partner with an established manufacturing base in the agricultural sector and with distribution and marketing channels already in place.
- U.S. patent process initiated by Northwest Precision Ag, Inc.

Economics and Commercial Potential

The United States' compounded annual growth rate for center-pivot irrigation systems has been 6 to 8 percent over the last 15 years. Market value of center-pivot irrigation systems among domestic producers is estimated to range between \$600 million and \$1 billion annually. These market statistics indicate two significant points: 1) center-pivot systems continue to expand in the market; and 2) center-pivot systems generate sizeable revenues.

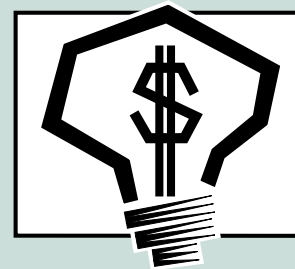
Among manufacturers and agricultural researchers, there is strong interest in the expanded use of center pivot systems to apply fertilizers and pesticides, as well as water, in a manner that more precisely meets the water, nutrient, and pest control needs of the crops under irrigation. GPS equipment used to generate detailed field maps is now available for integration into this new approach to irrigation and crop management.

Industry representatives agree that the approach being taken by Northwest Precision Ag, Inc., is worth exploring in depth. Cooperative research agreements between manufacturers and product developers are likely to continue into the future and are expected to better capture the costs and benefits of the energy-efficient irrigation system. Of growing interest to researchers is how to better predict the amount and timing of crop inputs—such as water, fertilizers, and pest-control chemicals—to provide the grower with a sound science on which to base the best crop-management tool available to growers in the decades ahead.

INDUSTRY OF THE FUTURE—AGRICULTURE

Agriculture, a target industry for the Industry of the Future initiative, emphasizes partnerships to develop technologies for using plants, crops, and their wastes as starting materials for industrial products. An agriculture industry team has been formed within OIT to facilitate agriculture industry/federal government partnerships. This team will leverage resources available to established OIT teams, such as the chemicals and forest products teams, to strengthen the contributions of the agriculture team and to bring new ideas to the service of the agriculture industry.

OIT Agriculture Industry Team Leader: Doug Faulkner (202) 586-2119.



The Inventions and Innovation Program works with inventors of energy-related technologies to establish technical performance and conduct early development. Ideas that have significant energy savings impact and market potential are chosen for financial assistance through a competitive solicitation process. Technical guidance and commercialization support are also extended to successful applicants.

PROJECT PARTNERS

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